Geophysical Research Abstracts, Vol. 8, 04324, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04324

The role of soil organic colloids in the retention of prion proteins

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The dissemination of Transmissible Spongiform Encephalopathy (TSE) diseases is of great environmental concern because of their high risk for human and environmental health. The “prion-only” hypothesis states that prion protein (PrP) is the main infectious agent of TSE diseases caused by the refolding of the PrPc, a normal host cellular protein, into the pathological form PrPsc. In TSE infected tissues it is found in abnormal forms, which is proteinase-K resistant and sedimentable.

Soil is a natural sink of several contaminants potentially including also prion proteins. Prion proteins may be dispersed in it because of several accidental or intentional events linked to the disposal and management of TSE infective materials. One into the soil, prion proteins may become adsorbed and/or entrapped onto/in organic and organo-mineral colloids and preserve their activity and functionality. Severe variations of their structure and an increase of infectivity may also occur. Consequently, understanding the retention and/or the dissemination of prion proteins in soils may be important for dealing with the dissemination of TSE infectivity.

The main goal of this work is to investigate the interactions of a recombinant ovine prion protein, recPrP, used as a surrogate of PrPc, with synthetic organic matrices simulating natural organic soil colloids. A humic-like precursor, catechol, and an abiotic soil catalyst, birnessite, interacted with recPrP giving rise to polymeric aggregates. By following particular and differentiated experimental conditions soluble and insoluble polymers were preferentially obtained with 3 and 5 mM catechol, respectively. By HPLC and protein concentration measurements, it was established that catechol was always fully removed from the reaction mixture and the protein was completely entrapped in the catechol polymers, whichever the experimental conditions adopted. By

contrast, chemical and structural analyses indicated that the protein molecules were differently located on the catechol-protein polymeric aggregates whether the recPrP was added before or after the catechol polymerization process.

Finally, desorption/extraction studies performed with common natural desorbing agents showed that the recPrP was not extractable, thus suggesting an irreversible adsorption/entrapment phenomenon.

Although obtained with synthetic models, the achieved results seem to suggest that in soil organic colloids could strong interact with prion protein, possibly interfering and modifying its behavior and availability.

Acknowledgment. This work was carried out with the support of Quality of Life Program (Contract QLK4-CT-2002-02493).